We claim:

1   1. A method comprising:

2   (a) determining a candidate sagittal direction for a brain image, said brain image defined

3   by brain volume data in a three-dimensional space associated with first, second and third

4   directions, said first, second and third directions being orthogonal to each other, said

5   candidate sagittal direction being the closest direction of said first, second and third

6   directions to an actual sagittal direction, said determining said candidate sagittal direction

7   comprising:

8   defining a first three-dimensional volume of interest of said brain image;

9   obtaining brain volume data in said first volume of interest for a first plurality of

10   slices in said first direction;

11   defining a second three-dimensional volume of interest of said brain image;

12   obtaining brain volume data in said second volume of interest for a second

13   plurality of slices in said second direction;

14   defining a third three-dimensional volume of interest of said brain image;

15   obtaining brain volume data in said third volume of interest for a third plurality of

16   slices in said third direction;

17   determining a measure for each slice of said first, second and third plurality of

18   slices;

19   for each of said first, second and third plurality of slices, plotting said measure for

20   said each slice of said plurality of slices, sequentially along a plot axis

21   corresponding to respective first, second and third directions, to produce first,

22   second and third measure plots; and

23   determining, from said first, second and third measure plots, which of said first,

24   second and third directions is said candidate sagittal direction with a candidate

25   plurality of slices associated therewith.

1   2. A method as claimed in claim 1 wherein said determining which of said first, second and

2   third directions is said candidate sagittal direction comprises recognizing, from said first, second

3   and third measure plots, a candidate plot, having a single monotonic increasing trend in measures

4   substantially adjacent to a single monotonic decreasing trend in measures, for which said

5   respective plot axis corresponds to said candidate sagittal direction.

1   3. A method as claimed in claim 1 wherein said determining which of said first, second and

2   third directions is said candidate sagittal direction comprises recognizing, from said first, second

3   and third measure plots, a candidate plot, having the greatest degree of symmetry about an axis

4   orthogonal to said respective plot axis, for which said respective plot axis corresponds to said

5   candidate sagittal direction.

1   4. The method of claim 1 further comprising, after (a):

2   (b) selecting a candidate mid-sagittal slice among said candidate plurality of slices, where

3   a measure determined for said candidate mid-sagittal slice is an optimal measure among

4   said measures determined for slices in said candidate plurality of slices.

1   5. The method of any one of claims 1-4 wherein said determining said measure for said each

2   slice requires determining a value for a function of intensity data associated with said each slice.

1   6. The method of any one of claims 1-5 wherein said determining said measure for said each

2   slice requires determining a measure of energy of said data contained in said each slice.

1   7. The method of any one of claims 1-5 wherein said determining said measure for said each

2   slice requires determining a measure of entropy of said data contained in said each slice.

1   8. The method of claim 4 further comprising outputting coordinates of data contained in said

2   candidate mid-sagittal slice as vertices defining a candidate mid-sagittal plane.

1   9. The method of claim 8 further comprising determining an optimized mid-sagittal plane by

2   using said vertices defining said candidate mid-sagittal plane in an optimization technique to

3   produce an optimized mid-sagittal plane.

1   10. The method of claim 9 wherein said optimization technique is the Nelder-Mead optimization

2   technique.

1   11. A method of determining an approximate location for a mid-sagittal slice from a plurality of

2   slices of brain volume data, said method comprising:

3   obtaining said brain volume data for said plurality of slices, where said plurality of slices

4   is generally oriented parallel to a sagittal plane and said plurality of slices is positioned

5   along an axis that is normal to said sagittal plane;

6   determining a measure for each slice of said plurality of slices, wherein each said measure

7   is determined based on said brain volume data contained in said each slice; and

8   selecting a candidate mid-sagittal slice among said plurality of slices, based on

9   identifying an optimal measure amongst said measures determined for said each slice of

10 said plurality of slices.

1   12. The method of claim 11 further comprising outputting coordinates of said brain volume data

2   contained in said candidate mid-sagittal slice as vertices defining a candidate mid-sagittal plane.

1   13. The method of claim 12 further comprising determining an optimized mid-sagittal plane by

2   using said candidate mid-sagittal plane in an optimization technique to produce said optimized

3   mid-sagittal plane.

1   14. The method of any of claims 11-13 wherein said obtaining said brain volume data comprises:

2   obtaining brain volume data for a first plurality of slices in a first direction;

3   obtaining brain volume data for a second plurality of slices in a second direction; and

4   obtaining brain volume data for a third plurality of slices in a third direction;

5   where said first, second and third directions are orthogonal to each other.

1   15. A method as claimed in claim 14 further comprising identifying which of said first, second

2   and third pluralities of slices is generally oriented parallel to said sagittal plane.

1   16. The method of any one of claims 11-15 wherein said determining said measure for said each

2   slice requires determining a value for a function of intensity data associated with said each slice.

1   17. The method of any one of claims 11-16 wherein said determining said measure for said each

2   slice requires determining a measure of energy of said brain volume data contained in said each

3   slice.

1   18. The method of claim 17 where said data contained in said each slice includes an intensity

2   value associated with each pixel in a plurality of pixels and said determining said measure for

3   said each slice includes determining a sum of said intensity values associated with said each pixel

4   in said each slice.

1   19. The method of any one of claims 11-15 wherein said determining said measure for said each

2   slice requires determining a measure of entropy of said brain volume data contained in said each

3   slice.

1   20. The method of claim 11 where said brain volume data contained in said each slice includes an

2   intensity value associated with each pixel in a plurality of pixels and said method further

3   comprises determining a first probability distribution for said each slice that includes, for each

4   intensity value in a predetermined range of intensity values, a probability that a pixel randomly

5   selected from among said plurality of pixels in said each slice has said each intensity value.

1   21. The method of claim 20 wherein said determining said measure for said each slice requires

2   utilizing said first probability distribution to obtain Shannon's entropy measure for said each

3   slice.

1   22. The method of claim 20 further comprising:

2   determining a second probability distribution for said each slice that includes, for said

3   each intensity value in said predetermined range of intensity values, a probability that a

4   pixel randomly selected from among pixels in a reference slice has said each intensity

5   value; and

6   said determining said measure for said each slice includes determining a Kullback-Leibler

7   distance between said first probability distribution and said second probability

8   distribution for said each slice.

1   23. The method of any of claims 12-22 further comprising normalizing said measure associated

2   with said each slice.

1   24. The method of any of claims 12-23 wherein said brain volume data is magnetic resonance

2   brain volume data.

1   25. A method comprising:

2   (a) determining a candidate sagittal direction for a brain image, said brain image defined

3   by brain volume data in a three-dimensional space associated with first, second and third

4   directions, said first second and third directions being orthogonal to each other, said

5   candidate sagittal direction being the closest direction of said first, second and third

6   directions to an actual sagittal direction, said determining of said candidate sagittal

7   direction comprising:

8   obtaining brain volume data for a first plurality of slices in said first direction;

9   obtaining brain volume data for a second plurality of slices in said second

10   direction;

11   obtaining brain volume data in for a third plurality of slices in said third direction;

12   determining a measure for each slice of said first second and third plurality of

13   slices;

14   for each of said first, second and third plurality of slices, plotting said measure for

15   said each slice of said plurality of slices, sequentially along an axis corresponding

16   to respective first, second and third directions to produce first, second and third

17   measure plots;

18   determining, from said first, second and third measure plots, which of said first,

19   second and third directions is said candidate sagittal direction with a candidate

20   plurality of slices associated therewith.

1   26. A method as claimed in claim 25 wherein said determining which of said first, second and

2   third directions is said candidate sagittal direction comprises recognizing, from said first, second

3   and third measure plots, a candidate plot, having a single monotonic increasing trend in measures

4   substantially adjacent to a single monotonic decreasing trend in measures, for which said

5   respective plot axis corresponds to said candidate sagittal direction.

1   27. A method as claimed in claim 25 wherein said determining which of said first, second and

2   third directions is said candidate sagittal direction comprises recognizing, from said first, second

3   and third measure plots, a candidate plot, having the greatest degree of symmetry about an axis

4   orthogonal to said respective plot axis, for which said respective plot axis corresponds to said

5   candidate sagittal direction.

1   28. The method of claim 25 further comprising, after (a):

2   (b) selecting a candidate mid-sagittal slice among said candidate plurality of slices, where

3   a measure determined for said candidate mid-sagittal slice is an optimal measure among

4   said measures determined for slices in said candidate plurality of slices.

5   29. A method comprising:

6   (a) determining a candidate sagittal direction for a brain image, said brain image defined

7   by brain volume data in a three-dimensional space and being associated with first and

8   second directions which are oriented at an angle to each other, said candidate sagittal

9   direction being the closest direction of said first and second directions to an actual sagittal

10   direction, said determining of said candidate sagittal direction comprising:

11   obtaining brain volume data for a first plurality of slices in said first direction;

12   obtaining brain volume data for a second plurality of slices in said second

13   direction;

14   determining a measure for each slice of said first and second plurality of slices;

15   for each of said first and second plurality of slices, plotting said measure for said

16   each slice of said plurality of slices, sequentially along an axis corresponding to

17   respective first and second directions to produce first and second measure plots;

18   and determining, from said first and second and measure plots, which of said first

19   and second directions is said candidate sagittal direction with a candidate plurality

20   of slices associated therewith.